# Study of lung functions in adolescent runners and non-runners

Sable M[1], Sable S[2], Kowale R[3], Ingole A[4], Somwanshi SD[5]

[1]Assistant Professor, Dept. of Physiology, B J Govt. Medical College, Pune
[2]Associate Professor, Dept. of surgery, Dr. D. Y. Patil Medical College & Hospital, Pune
[3]Post Graduate student, Dept. of Physiotherapy, Dr. D. Y. Patil Medical College, Pune.
[4]Assistant Prof. Dept. of Physiology, GMC, Latur.
[5]Assistant Prof. Maharashtra Institute of Medical Sciences and Research, Latur
meenakshisable@rediffmail.com

**Abstract**:

The purpose of this study was to evaluate lung functions in forty athletes and forty non-athletes in age range of 13-20 years. The athletes selected for this study are given training since last three years in running event. The variables studied were tidal volume(TV), forced vital capacity (FVC), forced expiratory volume in one second(FEV1), forced expiratory volume in three seconds(FEV3), forced expiratory volume in six second(FEV6), Inspiratory capacity(IC), expiratory reserve volume(ERV), & maximum voluntary ventilation(MVV) were found significantly higher in athletes than non-athletes. The findings suggest that during adolescence, development of lung under proper nutritional and health conditions is governed by the process of growth with negligible additional effect of physical activity. However, physical exercises during growth may help in developing a reduced resistance to expiration and a greater endurance in respiratory muscles. .

**Keywords:** Athletes, lung, functions, Non-athletes, training

## Introduction:

Athletics is great fun and people of all ages can enjoy it. Running is the most natural of athletics movements. Several factors like heredity, environment, diet, training, hormone status, socio-economic status, psychological trait etc contribute to performance of sportsman (1-2).

Lung function parameters tend to have a relationship with lifestyle such as regular exercise and non-exercise. Due to regular exercise athletes tend to have an increase in pulmonary capacity when compared with non-exercising individuals (3-4).Lung function tests provide qualitative and quantitative evaluation of pulmonary function and definite value in diagnosis of respiratory diseases (5-7). The aim of present study was to assess whether regular training affects the lung functions in athletes and non-athletes

## Methods:

Study was conducted on 40 athletes and 40 non-athletes aged 13 to 20 years. The athletes were undergoing training under Sports Authority of India western region and Krida Probhodini, Aurangabad for short and middle distance running events. The athletes were undergoing training continuously since 3 yrs.

The non-athletes selected for study were school/college going students. They were not practicing any event. All the subjects were clinically examined to rule out any respiratory disorder. Informed consent was obtained from all participants. Athletes remained actively engaged in their sports events during the tenure of this trial. The study was conducted in the Department of Physiology, Govt. Medical College, Aurangabad. The lung functions were recordedin Pulmonary Function Test laboratory by Body Plethysmograph (Med-Graphics USA) Elite-DX model PFT machine. Subjects were made familiar with test procedure & techniques. Static & Dynamic lung volumes & capacities were measured

Tidal volume (TV), forced vital capacity (FVC),Slow vital capacity(SVC), Inspiratory capacity(IC), Expiratory reserve volume (ERV),Forced expiratory volume at first second (FEV1),forced expiratory volume at third second (FEV3),Forced expiratory volume in sixth second (FEV6).Tidal volume & MVV were recorded with subject in sitting position on PFT machine. Subjects were encouraged throughout the test procedure. Standard statistical analysis tests were applied in terms of mean & standard deviation. Unpaired ‘t’ test was applied for comparison between two groups.

## Results:

The physical characteristics like age, height & weight of the subjects are given in Table 1.The mean values +_ SD for TV,FVC,SVC,FEV1,FEV3 &FEV6 for both groups are given in Table-1 & mean values +_ SD for IC,ERV & MVV are illustrated in Table 2.

**Table1: Physical Characteristics of Athletes and Non-athletes (mean+_SD)**

| | Age(yrs) | Height (cm) | Weight(kg) |
|---|---|---|---|
| Non Runners | 16.2+_2.04 | 162.33+_9.98 | 51.77+_11 |
| Runners | 15.35+_3.20 | 165.38+_7.10 | 53.85+-10.44 |

TV, FVC and Other Parameters of Both the Groups (mean+_SD)

**Table 2: IC, ERV, MVV in Runners and Nonrunners (Mean+-SD)**

| Parameters | Runners | Nonrunners | Statistical Significance |
|---|---|---|---|
| TV | 1.68+-0.73 | 1.47+_0.47 | S* |
| FVC | 89.6+-8.32 | 83+-11.30 | S* |
| SVC | 79.2+_25.07 | 77.15+_16.50 | |
| FEV1 | 88.3+_13.40 | 86.27+-8.39 | |
| FEV3 | 3.81+-0.60 | 3.63+-0.47 | |
| FEV6 | 4.02+-0.76 | 3.64+-0.47 | S* |
| Parameters | Runners | Nonrunners | S S |
| IC | 79.92+_18.73 | 75.92+_17.46 | NS |
| ERV | 82.45+_58.14 | 80.67+-31.01 | NS |
| MVV | 121.75+_57.37 | 87.60+-12.87 | HS |

P<0.05
HS-Highly significant
NS-Not significant

**Discussion:**

The term adolescence is defined as the period from puberty to full sexual maturation and is concerned with the physical, mental and the social growth. Growth spurt at adolecence involves every muscular and skeletal dimensions of the body. It has been observed that adolecents habituated to high level of physical activity have on an average greater lung volumes than their sedentary counterparts of comparable age and body sizes (9). Views have been expressed that training during this period, as compared with training after may be of greater importance in determining the ultimate dimensions of the lung (10,11). However, in the recent past, a number of studies have failed to find effects of endurance exercise training on most aspects of lung function. Lung volumes and capacities, Carbon monoxide diffusing capacity, pulmonary ventilation to perfusion ratio, and ventilatory responses to hypoxia, hypercapnia or exercise are all unaltered by training (12-14). Thus effects of training during adolescence are not well.

Results obtained from table 1 showed higher mean value of body weight & height in athletes that reflects higher growth pattern. Regular physical activity & training help in growth (8-9)

Table 2 showed that athletes are having a significantly higher tidal volume, forced vital capacity, forced expiratory volume at sixth seconds than that of non-athletes. Mean slow vital capacity, FEV1 &FEV3 were found more in athletes than non-athletes. Hagberg reported that values for static lung volumes (TV & FVC) of Marathons& other endurance trained athletes were no different from those of untrained controls of comparable body size (10).However Cordain reported that static lung volumes were larger than normal in swimmers and runners. This was attributed to strengthening of the inspiratory muscles as they work against additional resistance caused by weight of water that compresses the thoracic cage (11). It may be presumed that in the present study athletic training was not associated with detectable improvement in these lung functions, since there existed no ventilatory stress in this form of training analogous to those present in swim training (10).Other studies also indicate a significantly higher vital capacity in athletes compared with non-athetes (12-13).The finding may be due to genetic and ethnic factors as suggested by Lakhera & Kain who compared pulmonary functions against athletes in different Indian population(14).

Our data from table 2 showed statistically non-significant values of IC &ERV in athletes(runners)& non-athletes (non-runners).But MVV was significantly higher in runners than non-runners. Significant difference of MVV in athletes & non-athletes shows that athletes superior respiratory power & low resistance to air movement in the lungs. The higher MVV is advantageous for physical work capacity(15-17).Robinson & kjeldgard also have reported increased MVV & FEV1 (a dynamic lung volume indicates impairment of airway resistance) with training in running event(6).This finding suggest that training given to the athletes may have strengthened the respiratory muscles but have not affected airway resistance.

Odunga et al showed that among male athletes only the male shot putters had a significantly higher vital capacity than male non-athletes (18).The higher values of MVV in all groups of athletes in comparison to predicted normal values for Indians is in accordance to finding of Shapiro et al who observed that athletes have larger mean vital capacity & MVV.

Thus our data suggest that development of lung during adolescence in middle distance runners is governed by the process of growth with negligible additional effects of physical activity (13-14).In conclusion, our results show that running training during growth may help in developing a reduced resistance to expiration and a greater endurance in respiratory muscles

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